PATENT
Customer No. 22,852
Attorney Docket No. 7447.0061-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	
Eric GAUSSIER et al.	)	Group Art Unit: 2161
	)	
Application No.: 09/982,236	)	Examiner: NGUYEN, Cam Linh T.
	)	
Filed: October 19, 2001	)	
	)	
For: METHODS, SYSTEMS, AND ARTICLES OF MANUFACTURE FOR SOFT HIERARCHICAL CLUSTERING OF CO-OCCURRING OBJECTS	)	Confirmation No.: 7611

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

RESPONSE TO NOTIFICATION OF NON-COMPLIANT APPEAL BRIEF

In reply to the Notification of Non-Compliant Appeal Brief mailed November 7, 2006, Applicants provide a revised "Section V. Summary of Invention," which includes appropriate references to specification. According to section 1205.03 of the M.P.E.P.:

> When the Office holds the brief to be defective solely due to appellant's failure to provide a summary of the claimed subject matter as required by 37 CFR 41.37(c)(1)(v), an entire new brief need not, and should not, be filed. Rather, a paper providing a summary of the claimed subject matter as required by 37 CFR 41.37(c)(1)(v) will suffice.

Accordingly, Applicants provide a revised "Section V, Summary of the Claimed Subject Matter," in compliance with 37 CFR 41.37(c)(1)(v) as set forth below.

A revised **"Section V. Summary of Invention, "** begins on page 2 of this paper.

Remarks begin on page 13 of this paper.

V. Summary of Invention

The application describes methods, systems, and articles of manufacture for soft hierarchical clustering of objects based on a co-occurrence of object pairs. Clustering allows data to be hierarchically grouped (or clustered) based on its characteristics, so that objects, such as text data in documents that are similar to each other are placed in a common cluster in a hierarchy. In soft hierarchical clustering an object may be assigned to more than one cluster in a hierarchy as opposed to a hard assignment whereby an object is assigned to only one cluster in the hierarchy.

A modified Expectation-Maximization (EM) process is performed on object pairs reflecting documents and words, respectively, such that a given class of the objects ranges over all nodes of a topical hierarchy (as opposed to the leaves alone) and the assignment of a document to a topic may be based on any ancestor of the given class. Moreover, the assignment of a given document to any topic in the hierarchy may also be based on a particular (document, word) pair under consideration during the process. The modified EM process may be performed for every child class that is generated from an ancestor class until selected constraints associated with the topical hierarchy are met. A representation of the resultant hierarchy of topical clusters may be created and made available to entities that request the topics of the document collection. See, e.g., pg. 4, lines 22-23; and pg. 5, lines 1-11.

The modified algorithm eliminates the reliance on leaf nodes alone and allows any set S_i to be explained by a combination of any leaves and/or ancestor nodes included in an induced hierarchy. That is, *i* objects may not be considered as blocks,

but rather as pieces that may be assigned in a hierarchy based on any *j* co-occurring objects. In one configuration, a topical clustering application performed by a computer may assign parts of a document *i* to different nodes in an induced hierarchy for different words *j* included in the document *i*. See, e.g., pg. 15, lines 10-20.

For example, the probability of observing any pair of co-occurring objects, such as documents and words (*i*, *j*), may be modeled by defining a variable $I_{r\alpha}$ (controls the assignment of documents to a hierarchy) such that it is dependent on the particular document and word pair (*i*, *j*) under consideration during a topical clustering process. In one configuration, the class α may range over all nodes in an induced hierarchy in order to assign a document (*i* object) to any node in the hierarchy, not just leaves. Furthermore, by defining a class *v* as any ancestor of α in the hierarchy the nodes may be hierarchically organized. See, e.g., pg. 15, lines 21-23; and pg. 16, lines 1-6.

Different *j* objects may be generated from different vertical paths of an induced hierarchy. That is, from paths in the hierarchy associated with non null values of $I_{i\alpha}$. Furthermore, because α may be any node in the hierarchy, the *i* objects may be assigned to different levels of the hierarchy. Accordingly, implementation of the model results in a pure soft hierarchical clustering of both *i* and *j* objects by eliminating any hard assignments of these objects. See, e.g., pg. 18, lines 10- 21.

The model may be implemented for a variety of applications, depending upon the meaning given to objects *i* and *j*. For example, it may be applied to document clustering based on topic detection. In such a configuration, *i* objects may represent documents and *j* objects may represent words included in the documents. Clusters or topics of documents may be represented by leaves and/or nodes of an induced hierarchy. The

topics associated with the document collection may be obtained by interpreting any cluster as a topic defined by the word probability distributions, $p(j|v)$. The soft hierarchical model may take into account several properties when interpreting the clusters, such as: (1) a document may cover (or be explained by) several topics (soft assignment of *i* objects provided by the probability $p(i|\alpha)$); (2) a topic is best described by a set of words, which may belong to different topics due to polysemy (the property of a word to exhibit several different, but related meanings) and specialization (soft assignment of *j* objects provided by the probability $p(j|v)$); and (3) topics may be hierarchically organized, which corresponds to the hierarchy induced over clusters. See, e.g., pg. 20, lines 25-30; and pg. 21, lines 1-11.

One or more conditions associated with a hierarchy that may be induced may allow a computer to determine when an induced hierarchy reaches a desired structure with respect to the clusters defined therein. For example, a condition may be defined that instructs a processor to stop locating co-occurring objects (*i*, *j*) in a document collection that is being clustered based on a predetermined number of leaves, and/or a level of the induced hierarchy. See, e.g., pg. 23, lines 1-11.

Pending independent claim 1 recites a method performed by a computer for clustering a plurality of documents in a structure comprised of a plurality of clusters hierarchically organized, wherein each document includes a plurality of words and is represented as a set of (document, word) pairs. See, e.g., pg. 2, lines 11-18; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 13-23; and Fig. 6. The method comprises: accessing the document collection; performing a clustering process that creates a hierarchy of clusters that reflects a segregation of the documents in the collection based on the

words included in the documents, wherein any document in the collection may be assigned to a first cluster in the hierarchy based on a first segment of the respective document, and the respective document may be assigned to a second cluster in the hierarchy based on a second segment of the respective document, wherein the first and second clusters are associated with different paths of the hierarchy. See, e.g., pg. 2, lines 19-23; pg. 3, lines 1-4; pg. 20, lines 1-8; Fig. 5; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-7; Fig. 6; pg. 29, lines 17-18; pg. 30 lines 1-2; and Fig. 7. A representation of the hierarchy of clusters is stored in memory and made available to an entity in response to a request associated with the document collection. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17. Claims 2 - 7 all ultimately depend from claim 1.

Pending independent claim 8 recites a method performed by a computer for determining topics of a document collection, by accessing the document collection, wherein each document includes a plurality of words and is represented as a set of (document, word) pairs. See, e.g., pg. 2, lines 11-18; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 1-8 and 13-19; and Fig. 6. The method comprises performing a clustering process including: creating a tree of nodes that represent topics associated with the document collection based on the words in the document collection, wherein any node in the tree may include a word that is shared by another node in the tree, and assigning fragments of one or more documents included in the document collection to multiple nodes in the tree based on the (document, word) pairs and storing a representation of the tree in a memory. See, e.g., pg. 20, lines 1-8 and 13-19; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-23; pg. 26, lines 1-5; Fig. 6; pg. 29,

lines 17-18; pg. 30 lines 1-2; and Fig. 7. The representation is made available for processing operations associated with the document collection. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17. Claim 9 ultimately depends from claim 8.

Pending independent claim 10 recites a method performed by a processor for clustering data in a database by receiving a collection of documents, wherein each document includes a plurality of words and is represented as a set of (document, word) pairs. See, e.g., pg. 2, lines 11-18; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 13-23; pg. 25, lines 18-23; pg. 26, line 1; and Fig. 6. The method comprises creating a first ancestor node reflecting a first topic based on words included in the collection of documents; creating descendant nodes from the first ancestor node, each descendant node reflecting descendant topics based on the first node, until a set of leaf nodes reflecting leaf topics are created. See, e.g., pg. 14, lines 15-22; pg. 15, lines 1-13; pg. 16, lines 13-20; pg. 19, lines 12-18; and Fig. 5. The step of creating descendant nodes includes assigning each document in the collection to a plurality of descendant and leaf nodes; and providing a set of topics associated with the collection of documents based on the created nodes and assignment of documents, wherein the descendant and leaf nodes may be created based on one or more words included in more than one document in the collection of documents. See, e.g., pg. 19, lines 12-18; pg. 20, lines 1-8; pg. 21, lines 18-23; pg. 22, lines 1-4 and 11-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-23; pg. 26, lines 1-5; Fig. 6; pg. 26, lines 6-22; pg. 27, lines 1-16; pg. 28, lines 19-22; pg. 29, lines 1-3 and 17-18; pg. 30 lines 1-2; and Fig. 7. Claim 11 ultimately depends from claim 10.

Pending independent claim 12 recites a method performed by a processor for clustering data in a database by receiving a collection of documents, wherein each document includes a plurality of words and is represented as a set of (document, word) pairs. See, e.g., pg. 2, lines 11-18; pg. 4, lines 16-23; pg. 5, lines 1-4; pg. 7, lines 22-23; Fig. 1; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 13-23; pg. 25, lines 18-23; pg. 26, line 1; and Fig. 6. The method comprises creating a hierarchy of nodes based on the words in the collection of documents, each node reflecting a topic associated with the documents, wherein the hierarchy of nodes includes ancestor nodes, descendant nodes, and leaf nodes. Each document in the collection is assigned to a plurality of nodes in the hierarchy, wherein each document may be assigned to any of the ancestor, descendant, and leaf nodes. See, e.g., pg. 14, lines 15-22; pg. 15, lines 3-13; pg. 16, lines 13-20; pg. 19, lines 12-18; and Fig. 5. A set of topic clusters associated with the collection of documents is provided and based on the created nodes and assignment of documents, wherein the hierarchy may include a plurality of nodes that are each created based on a same set of words included in the collection of documents. See, e.g., pg. 26, lines 6-22; pg. 27, lines 1-16; pg. 28, lines 19-22; pg. 29, lines 1-3 and 17-18; pg. 30 lines 1-2; and Fig. 7.

Pending independent claim 13 recites a method performed by a computer for clustering data stored on a computer-readable medium by receiving a collection of data objects, represented as a set of (first data object, second data object) pairs. See, e.g., pg. 2, lines 11-18; pg. 4, lines 16-23; pg. 5, lines 1-4 and 18-20; pg. 6, lines 19-23; pg. 7, lines 1-3, 12-16 and 22-23; Fig. 1; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 13-23; pg. 25, lines 18-23; pg. 26, line 1; and Fig. 6. The method comprises: for each first data

object: assigning the first data object to a first node in a hierarchy of nodes based on the second data objects included in the first data object, wherein the first node may be any node included in the hierarchy and wherein two or more nodes in the hierarchy may share the same second object; creating a final hierarchy of nodes arranged in clusters based on the assignment of the first data objects. See, e.g., pg. 20, lines 1-8 and 13-19; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-23; pg. 26, lines 1-5; Fig. 6; pg. 29, lines 17-18; pg. 30, lines 1-2 and 11-15; and Fig. 7. A representation of the final hierarchy is stored in memory and made available to an entity in response to a request associated with the collection of first data objects. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17.

Pending independent claim 14 recites a method performed by a processor for clustering data in a database by receiving a request from a requesting entity to determine topics associated with a collection of documents, each document including a plurality of words and being represented as a set of (document, word) pairs. See, e.g., pg. 2, lines 11-18; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 13-23; pg. 25, lines 18-23; pg. 26, line 1; and Fig. 6. The method comprises determining the topics associated with the collection of documents based on a hierarchy including a plurality of clusters, wherein each cluster reflects a topic and a document in the collection may be assigned to a set of clusters in the hierarchy based on different words included in the document, and wherein each cluster in the set may be associated with different paths in the hierarchy. See, e.g., pg. 2, lines 19-23; pg. 3, lines 1-4; pg. 20, lines 1-8; Fig. 5; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-7; Fig. 6; pg. 29, lines 17-18; pg. 30 lines 1-2; and Fig. 7. A representation of the

hierarchy is stored in memory and made available to the requesting entity. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17.

Pending independent claim 15 recites a computer-implemented method for clustering a plurality of multi-word documents into a hierarchical data structure including a root node associated with a plurality of sub-nodes, wherein each sub-node is associated with a topic cluster based on the plurality of documents. See, e.g., pg. 2, lines 11-18; pg. 7, lines 22-23; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 1-8 and 13-19; and Fig. 6. The method comprises: retrieving a first document; associating the first document with a first topic cluster based on a first portion of the first document; associating the first document with a second topic cluster based on a second portion of the document; and providing a representation of topics associated with the plurality of multi-word documents based on the hierarchical data structure including the first and second topic clusters, wherein the first and second topic clusters are associated with a different sub-node. See, e.g., pg. 14, lines 15-22; pg. 15, lines 3-13; pg. 16, lines 13-20; pg. 19, lines 12-18; Fig. 5; pg. 25, lines 7-23; pg. 26, lines 1-5; Fig. 6; pg. 26, lines 6-22; pg. 27, lines 1-16; pg. 28, lines 19-22; pg. 29, lines 1-3 and 17-18; pg. 30, lines 1-2; and Fig. 7. Claims 16 - 19 all ultimately depend from claim 15.

Pending independent claim 20 recites a computer-implemented method for clustering data reflecting users, represented as a set of (data, user) pairs, into a hierarchical data structure including a root node associated with a plurality of sub-nodes, wherein each sub-node represents an action that is performed on a document collection. See, e.g., pg. 31, lines 1-4 and 22-23; pg. 30, lines 11-15; pg. 2, lines 11-18; pg. 7, lines 22-23; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 1-8 and 13-19; and Fig. 6.

The method comprises: accessing a user data collection reflecting a plurality of users who each perform at least one action on the document collection, wherein each action may be unique; performing a clustering process that creates the hierarchical data structure, wherein the clustering processing comprises: retrieving a first user data, associated with a first user, from the user data collection, associating the first user data with a first sub-node based on a first action performed by the first user on the document collection, and associating the first user data with a second sub-node provided the first user data is based on a second action, wherein the first and second sub-nodes are associated with different descendent paths of the hierarchical data structure. See, e.g., pg. 31, lines 1-4 and 22-23; pg. 30, lines 11-15; pg. 2, lines 19-23; pg. 3, lines 1-4; pg. 20, lines 1-8; Fig. 5; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-7; Fig. 6; pg. 29, lines 17-18; pg. 30, lines 1-2; and Fig. 7. A representation of the hierarchical data structure is stored in memory and made available to an entity in response to a request associated with the user data collection. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17. Claim 21 ultimately depends from claim 20.

Pending independent claim 22 recites a computer-implemented method for clustering a plurality of images based on text associated with the images, where each image is represented as a set of pairs (image, image feature) and (image, text feature), into a hierarchical data structure including a root node associated with a plurality of sub-nodes, wherein each sub-node represents a different topic. See, e.g., pg. 31, lines 5-7 and 22-23; pg. 30, lines 11-15; pg. 2, lines 11-18; pg. 7, lines 22-23; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 1-8 and 13-19; and Fig. 6. The method comprises: accessing an image collection; performing a clustering process that creates the hierarchical data

structure, wherein the clustering processing comprises: associating a first image with a first sub-node based on a first portion of text associated with the first image, and associating the first image with a second sub-node based on a second portion of text associated with the first image, wherein the first and second sub-nodes are associated with different descendant paths of the hierarchical data structure. See, e.g., pg. 31, lines 5-7 and 22-23; pg. 30, lines 11-15; pg. 2, lines 19-23; pg. 3, lines 1-4; pg. 20, lines 1-8; Fig. 5; pg. 21, lines 18-23; pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-7; Fig. 6; pg. 29, lines 17-18; pg. 30, lines 1-2; and Fig. 7. A representation of the hierarchical data structure is stored in memory and made available to an entity in response to a request associated with the image collection. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17.

Pending independent claim 23 recites a computer-implemented method for clustering customer purchases, represented as a set of (customer, purchase) pairs, into a hierarchical data structure including a root node associated with a plurality of sub-nodes, wherein each sub-node represents a group of customers who purchased the same type of product from one or more business entities. See, e.g., pg. 31, lines 8-23; pg. 30, lines 11-15; pg. 2, lines 11-18; pg. 7, lines 22-23; pg. 19, lines 12-18; Fig. 5; pg. 20, lines 1-8 and 13-19; and Fig. 6. The method comprises: accessing information associated with a plurality of customers who purchased various types of products from a plurality of business entities; performing a clustering process that creates the hierarchical data structure, wherein the clustering processing comprises: associating a first customer with a first sub-node based on a first type of product purchased from a first business entity, and associating the first customer with a second sub-node provided

the first customer is based on a second type of product that the first customer purchased from a second business entity, wherein the first and second sub-nodes are associated with different descendant paths of the hierarchical data structure. See, e.g., pg. 31, lines 8-23; pg. 30, lines 11-15; pg. 2, lines 19-23; pg. 3, lines 1-4; pg. 20, lines 1-8; Fig. 5; pg. 21, lines 18-23, pg. 22, lines 1-22; pg. 23, lines 1-23; pg. 24, lines 1-23; pg. 25, lines 1-7; Fig. 6; pg. 29, lines 17-18; pg. 30, lines 1-2; and Fig. 7. A representation of the hierarchical data structure is stored in memory and made available in response to a request associated with the customer data collection. See, e.g., pg. 20, lines 13-23; and pg. 21, lines 1-17. Claims 24-26 all ultimately depend from claim 23.

REMARKS

Appellants filed a Supplemental Appeal Brief on October 20, 2006, in response to the Office Action mailed on July 20, 2006, and pursuant to 37 C.F.R. 41.31, Appellants presented the Supplemental Appeal Brief and requested reinstatement of the Appeal, which was originally filed on November 22, 2005. On November 7, 2006, the Office mailed a Notification of Non-Compliant Appeal Brief ("Notification"). Specifically, the Notification asserts that the Appeal Brief did not map each independent claim (*i.e.*, claims 1, 8, 10, 12, 13, 14, 15, 20, 22, and 23) to the specification by page and line number. In response to the Notification, Appellants present a revised "Section V. Summary of Invention," which includes appropriate references to the specification and figures. Appellants submit that the present submission is fully responsive to the Notification, and is timely filed.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this response, such extension is hereby respectfully requested. If there are any additional fees due that are not enclosed, please charge such fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Linda J. Marr 45,687
for Venk Krishnamoorthy, Ph.D.
Reg. No. 52,490

Dated: December 7, 2006